

Abstract

When using Voice over IP (VoIP) in Wireless Mesh Networks the overhead induced by the IEEE 802.11 PHY and MAC layer accounts for more than 80% of the channel utilization time, while the actual payload only uses 20% of the time. As a consequence, the Voice over IP capacity is very low. To increase the channel utilization efficiency and the capacity several IP packets can be aggregated in one large packet and transmitted at once. This paper presents a new hop-by-hop IP packet aggregation scheme for Wireless Mesh Networks.

The size of the aggregation packets is a very important performance factor. Too small packets yield poor aggregation efficiency; too large packets are likely to get dropped when the channel quality is poor. Two novel distributed protocols for calculation of the optimum respectively maximum packet size are described. The first protocol assesses network load by counting the arrival rate of routing protocol probe messages and constantly measuring the signal-to-noise ratio of the channel. Thereby the optimum packet size of the current channel condition can be calculated. The second protocol, which is a simplified version of the first one, measures the signal-to-noise ratio and calculates the maximum packet size.

The latter method is implemented in the ns-2 network simulator. Performance measurements with no aggregation, a fixed maximum packet size and an adaptive maximum packet size are conducted in two different topologies. Simulation results show that packet aggregation can more than double the number of supported VoIP calls in a Wireless Mesh Network. Adaptively determining the maximum packet size is especially useful when the nodes have different distances or the channel quality is very poor. In that case, adaptive aggregation supports twice as many VoIP calls as fixed maximum packet size aggregation.

Keywords: Wireless Mesh Network, Voice over IP, Packet Aggregation